

Particulate Matter Pyramid of Effects and Pertinent Health Studies

(Note: These are only selected studies that were chosen by the Air District to exemplify the health effects of PM. Refer to the EPA listed health studies for a comprehensive listing considered for NAAQS revision.)

Lung function decrements, inflammation and permeability, susceptibility to infection, cardiac effects

Author	Journal	Factoid
Kunzli, N. et al. 2005	Environmental Health Perspectives	The study showed a 4.3% increase in carotid artery intima-media thickness (CIMT) per 10 $\mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$, which is epidemiologic evidence of an association between atherosclerosis and $\text{PM}_{2.5}$.
Gauderman, W.J. et al. 2004	New England Journal of Medicine	An eight year study of more than 1,700 children (average age, 10 years) from 12 southern California communities, found that the proportion of children with low lung function was about five times greater in the community with the highest level of $\text{PM}_{2.5}$ compared with the community with the lowest levels.

Respiratory symptoms, medication use, asthma attacks

Author	Journal	Factoid
Mar, T.F. et al. 2004	Inhalation Toxicology	Strong association was found between cough and $\text{PM}_{2.5}$ in children.
Rabinovitch, N. et al. 2006	American Journal of Respiratory and Critical Care Medicine	In a two-year study of schoolchildren with severe asthma, peak concentrations of $\text{PM}_{2.5}$ were found to be associated with increase use of asthma medication.

Doctor visits, school absences

Author	Journal	Factoid
Ransom, M.R. and Pope, C.A. III 1992	Environmental Research	A study of kindergarten children found that a 100 $\mu\text{g}/\text{m}^3$ increase in the 28-day moving average of PM_{10} was associated with a 40% increase in overall school absences. This association was observed even at PM_{10} levels below 150 $\mu\text{g}/\text{m}^3$.

ER visits, hospital admissions

Author	Journal	Factoid
Dominici, F. et al. 2006	Journal of the American Medical Association	A study of 11.5 million Medicare participants found 1.28% increase in hospital admission rate for heart failure per 10 $\mu\text{g}/\text{m}^3$ increase in same-day $\text{PM}_{2.5}$. Short-term exposure to $\text{PM}_{2.5}$ increases the risk for hospital admission for cardiovascular and respiratory diseases.
Metzger, K.B. et al. 2004	Epidemiology	Cardiovascular disease emergency department visits were associated with $\text{PM}_{2.5}$. Associations were strongest with same-day $\text{PM}_{2.5}$ levels.

Death

Author	Journal	Factoid
Chen, L. H. et al. 2005	Environmental Health Perspectives	In females, the relative risk for fatal coronary heart disease (CHD) with each 10 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ was 1.42. Those exposed to levels greater than 38 $\mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$ were 2.3 times more likely to die of CHD than those living in areas where concentrations were less than or equal to 25 $\mu\text{g}/\text{m}^3$.
Pope, C.A. et al. 2002	Journal of the American Medical Association	A study of approximately 1.2 million adults found a 6% and 8% increased risk of cardiopulmonary and lung cancer mortality, respectively, for each 10 $\mu\text{g}/\text{m}^3$ elevation in long-term average $\text{PM}_{2.5}$ ambient air concentration.
Pope, C.A. et al. 2004	Circulation	Statistically robust associations between $\text{PM}_{2.5}$ and overall cardiovascular disease mortality were observed. Fine particulate air pollution is a risk factor for cardiovascular disease mortality.

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